

Advanced Techniques for improving Wind Direction Ambiguity Removal in Scatterometry

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Ocean surface winds, which drive the ocean currents and momentum flux exchanges, are critical for numerous atmospheric and oceanographic studies. Ocean surface winds also generate small capillary waves which affect the normalized radar cross section (σ^0) of the ocean surface. A scatterometer is a microwave radar which measures ocean surface σ^0 values which, in turn, can be used to determine the driving wind speed and direction through the inversion of an empirical model function relating σ^0 to wind speed and direction. Unfortunately, for a given value of σ^0 , there is not a unique wind vector solution. Multiple σ^0 measurements of the same ocean area using different viewing geometries and/or polarizations can be used to reduce the number of possible wind vector solutions.

Seasat-A was launched in 1978 to perform global mapping of ocean surface wind fields using scatterometry. Following the success of the Seasat mission, the NASA Scatterometer (NSCAT) was designed and built to be launched on ADEOS in August of 1996. Whereas Seasat only measured σ^0 from two different viewing geometries producing four equally likely wind vector solutions, NSCAT will have improved instrument skill by measuring σ^0 from three different viewing geometries with one of the antennas making dual-polarization measurements. The NSCAT configuration provides additional information to assist in the selection of a wind vector solution. The process of selecting one of the wind vector solutions to represent the true wind vector is referred to as ambiguity removal or dealiasing.

The ambiguity removal algorithm currently planned for NSCAT utilizes a simple median filter. From simulations, it has been determined that the median filtering technique will have an average skill of about 90 %, i.e. it will select the wind vector nearest to the true direction about 90% of the time. The remaining errors in the wind field after ambiguity removal tend to be clustered together, span the entire swath (600 km), and extend in the along-track direction for several hundred kilometers. Errors also tend to produce sharp discontinuities in the selected wind field in regions where there are no such discontinuities in the true wind field. We will discuss techniques and problems associated with ambiguity removal and outline several new methods which can be used to improve ambiguity removal performance. Techniques are applied to simulated NSCAT data but can be generalized to other scatterometer instruments such as the ERS - 1 and ERS - 2 scatterometers and SeaWinds to be launched aboard ADEOS-II.